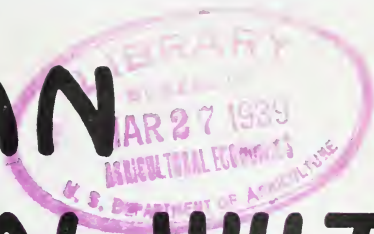


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BEAN BACTERIAL WILT



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U.S. DEPARTMENT OF AGRICULTURE



BEAN BACTERIAL WILT

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Signs of the Disease

Bacterial wilt of bean has been known since 1921.¹ It produces the following symptoms: Seedling wilt when the plants are 2 to 3 inches high, wilting and defoliation of older plants or portions thereof (front page illustration and figs. 4, 5, 6), girdling of the stems of young

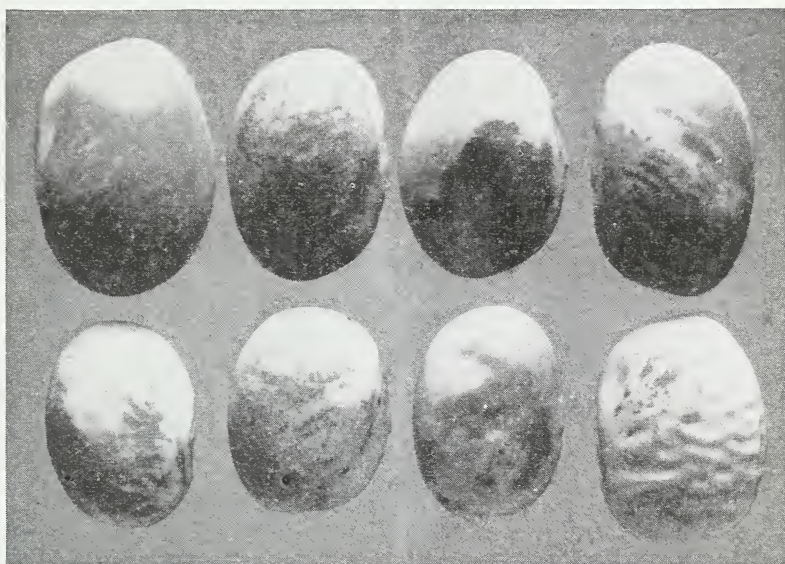


FIGURE 1.—Typical bacterial-wilt-infected seed selected from Michigan navy bean culls. The areas which appear dark in the photograph are bright yellow. (From U. S. Dept. Agr. Yearbook 1926, p. 166, fig. 19.)

or mature plants that causes them to break over easily in a high wind or when cultivated, and, in white-seeded varieties, conspicuous bright-yellow seeds.

This color is not due to a discoloration of the seed coat, such as may be caused by weathering, but to bright-yellow masses of bacteria underneath it and visible through it (figs. 1 and 3). There are no definite leaf spots, and the discoloration of the foliage, which sometimes precedes wilting, is not conspicuous. Occasionally the pods show striking signs of disease, such as is shown in figure 2, A. A

¹ A full account of the experimental work on this disease, including a technical description of the parasite, was published by the writer in *Phytopathology*, Vol. 16, No. 1, January 1926, in a paper entitled "Bacterial Wilt of Beans (*Bact. flaccumfaciens* Hedges), Including Comparisons With *Bact. phaseoli*."

discoloration confined to the suture (fig. 2, *B*, and *C*) is more common, but the majority of infected pods show no external signs of disease whatsoever (fig. 3). The striking symptoms are the wilting and defoliation of the plants and bright-yellow seed of white-seeded varieties.

The cover shows navy bean plants in a South Dakota field killed by bacterial wilt in 1921. (Courtesy of L. T. Leonard, U. S. Department of Agriculture.)



FIGURE 2.—Mature Early Wonder pods showing unusual external evidence of infection. Such obvious signs of bacterial wilt on the pod are not common (compare with fig. 3): *A*, Discoloration extending beyond suture (rarely seen); *B* and *C*, discoloration confined to suture. (Collected in a Michigan field in 1923.)

History

Investigation of this disease began when it came to the writer's attention in 1921 that wilt and a consequent 25-percent loss had occurred in a field of navy beans in South Dakota. The seed used had been harvested from a field showing a similar wilt and a 90-percent crop loss the year before (front page illustration and fig. 4).

The following year (1922) the wilt was the most serious of the bean diseases occurring in Michigan; field after field in that State showed conspicuous wilting in the late summer. In some cases as many as 90 percent of the plants were affected.

A field survey of several of Michigan's largest navy bean-growing centers was made in June of the following year, as it was to be expected that considerable infected seed would be planted because of the prevalence of the disease the previous year. Seedling wilt was found in many fields, and in every such case an examination of the remnants of the seed stock revealed the presence of the bright-yellow seeds (fig. 1).

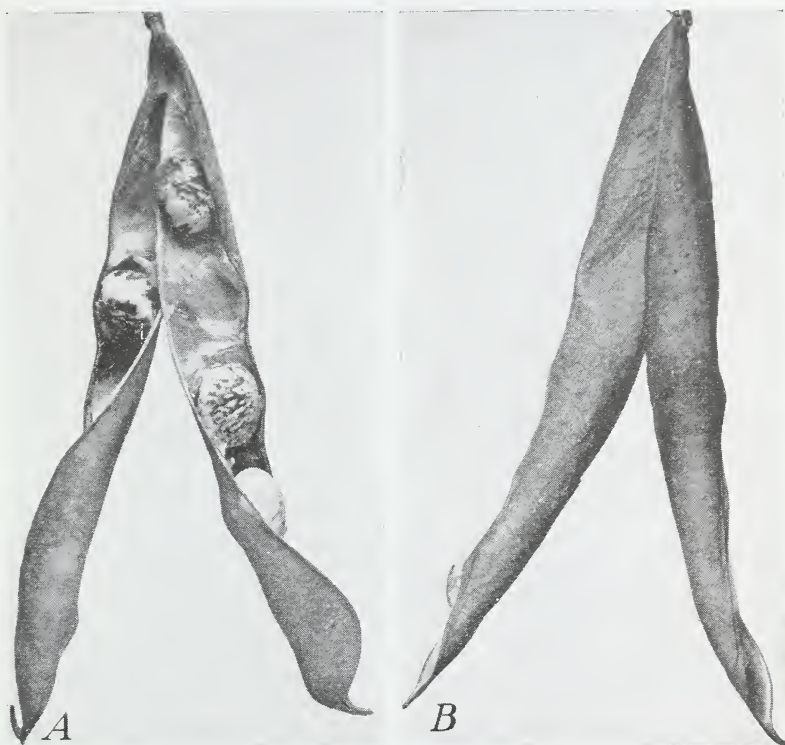


FIGURE 3.—Interior (*A*) and exterior (*B*) view of a navy bean pod showing no external evidence of disease but containing seeds infected with bacterial wilt. (Collected in a Michigan field, 1922. Compare with fig. 2.)

In August 1923 another survey was made, and, wherever seedling wilt had been found in June, infected pods and seed were present in August (fig. 2).

For a series of years, 1923–29, culls were obtained in 50-pound lots from one of the Michigan elevators and among these discolored seeds the bright-yellow ones were always found.

It was found that the wilt organism obtained from seed 5 years old was still very virulent and produced 100-percent wilt when inoculated into healthy bean seedlings.

Geographical Distribution

The disease has been reported from Maryland, Michigan, Montana, North Dakota, and South Dakota, Oregon, Wyoming, and West Virginia; also from Canada, France, Germany, Belgium, Bulgaria, and Australia.

Susceptible Varieties

The wilt has been found in this country in fields of common navy, navy pea bean, pea bean, Pilot Navy, Robust, Improved Robust, Black Valentine, Crystal White Wax, Early Wonder, Golden Eye Wax, Wardwell Kidney Wax, White Kidney Wax, Blue Lake, Great



FIGURE 4.—Navy bean plant badly infected but not killed by bacterial wilt. Such plants are the sources of infected seed. (Collected at Redfield, S. Dak., 1921. Courtesy of L. T. Leonard.)

Northern, a pink-seeded variety from Michigan, and Henderson Bush lima (fig. 5).

Tests of 91 American varieties by Rands and Brotherton² failed to show marked resistance in any of them (fig. 6).

Control

The only agent of dissemination thus far known is infected seed. Unlike the common bean blight and the halo blight, both of which are also seed-borne bacterial diseases, this wilt appears to spread little if any in the field, but infected seed produce infected plants, which either die in the seedling stage or produce more infected seed.

The hand picking of seed practiced by reliable seed elevators greatly reduces the hazard, but better still is the practice of examining fields, both early and late, during the growing season, and using as fit sources of seed supply only those that have a minimum of disease of any kind. Such a practice, together with careful hand picking for a period of years, should result in a notable cleaning-up of the seed stock.

² RANDS, R. D., and BROTHERTON, WILBUR, JR. BEAN VARIETAL TESTS FOR DISEASE RESISTANCE. *Jour. Agr. Research*. 31:101-154. 1925.

A forward-looking Michigan firm operating 10 elevators in that State has for several years bought the best seed obtainable in the State, usually seed that has been certified by the Michigan Crop



FIGURE 5.—Bacterial wilt on six varieties of beans 4 weeks after their inoculation with the wilt organism. Complete defoliation in several. One hundred-percent infection was obtained. The checks are on the right. Varieties inoculated were Black Valentine, Wardwell Kidney Wax, Early Wonder, Lady Washington, Red Kidney, Vaughan Monster Stringless Wax.

Improvement Association cooperating with the Michigan Agricultural Experiment Station. This seed the firm exchanges bushel for bushel for that raised by its contract farmers. The latter seed is then cleaned and sold to the trade as table stock but not for seed.

The results are well-satisfied customers and gradual but steady improvement in the seed stock in those portions of the State. Such a "health program" is to be highly recommended.

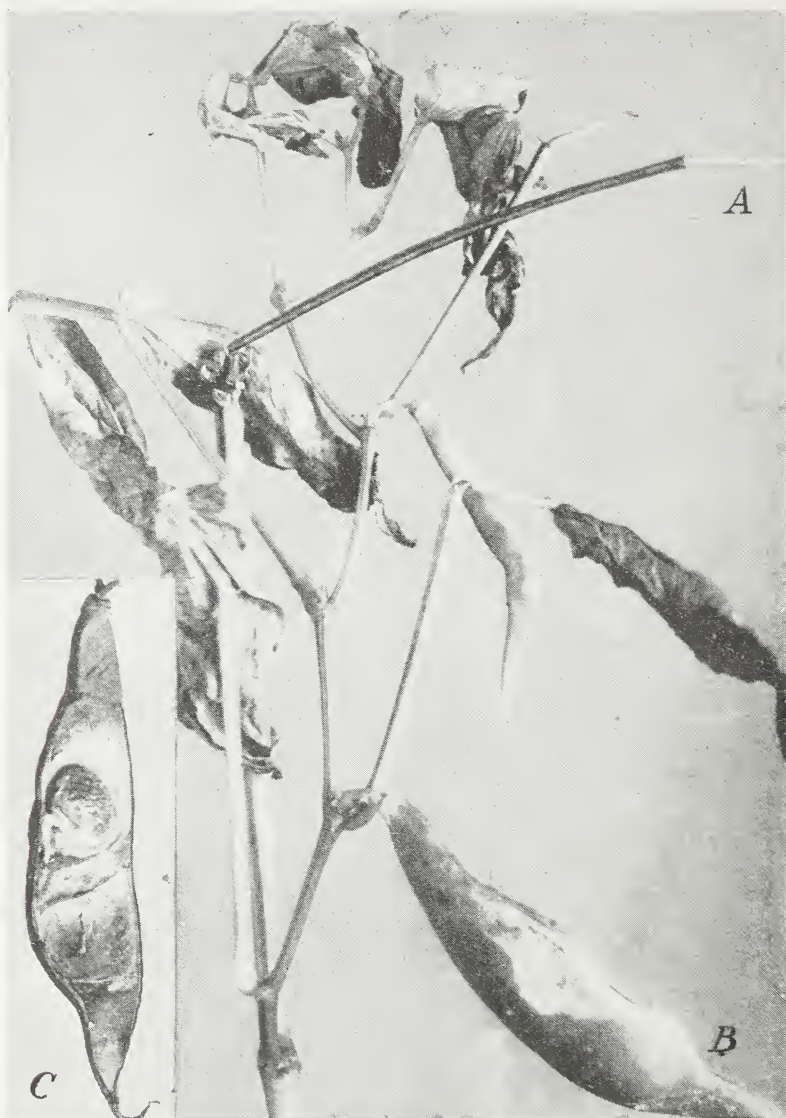


FIGURE 6.—Lazy Wife pole bean 2 months after stem inoculation with the bacterial wilt organism: *A*, Whole top of main stem defoliated and dead; *B*, infected pod; *C*, photograph of the interior of the same pod 3 days later, showing infected seed.

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